

THE APPLICATION
of
ESEA'S TECHNOLOGY
in
TODAY'S WORLD

*(The transmission of power without
the use of cables or wires.)*

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THE APPLICATION
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TESLA'S TECHNOLOGY
IN
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*(The transmission of power without
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(Under the rules of the Philadelphia, Montreal
and Midwest Stock Exchanges it is required that
an investment research report be approved by a
director of the firm. This requirement has been
complied with in respect to this report.)

27 January 1973

THE APPLICATION OF TESLA'S TECHNOLOGY
IN TODAY'S WORLD

I N T R O D U C T I O N

There can be no parameters to investment research because human society constantly generates change.

The pursuit of investment research is to try and identify change before its broad impact is generally understood. This is an unusual report because the subject matter is so foreign to most investors, bankers and analysts but yet the implications will be so great on the work they try to do and the responsibilities they have that it is necessary that they now acquire a background knowledge as to how the normal human brain can be externally controlled by electromagnetic waves.

First it is necessary to have some background to Nikola Tesla. Secondly, understand what the Soviet Union is doing in the field of producing high-powered, low-frequency, long standing electromagnetic waves; the impact that these appear to be having on meteorological conditions and then finally the applications of this technology by the military.

This report is by no means complete and it is only intended to create an awareness.

NIKOLA TESLA

Nikola Tesla was born in Yugoslavia in 1856. His father was an orthodox priest and his mother, although uneducated, was highly intelligent. Tesla was a dreamer with a poetic touch, who as he matured, acquired strong qualities of self-discipline.

He attended the Technical University at Graz, Austria and then in 1882, he went to work in Paris for The Continental Edison Company. During his free periods he constructed the first induction motor. He arrived in the United States in 1884 with four cents in his pocket and a few of his own poems and calculations for a flying machine. He found employment with Thomas Edison, but as inventors they were too diverse.

In 1885, George Westinghouse, head of the Westinghouse Electric Company in Pittsburgh bought the patent rights to Tesla's polyphase system of alternating current dynamos, transformers and motors and this started the great struggle between the direct current systems of Edison and the Tesla-Westinghouse alternating current approach. Westinghouse eventually won out.

The Tesla coil which Tesla invented in 1891 is widely used today in radio and television sets and other electronic equipment.

In the period from 1899 to 1900, Tesla stayed in Colorado Springs where he made one of his most important discoveries. This was terrestrial stationary waves. In this discovery, he proved that the earth could be used as a conductor and would be as responsive as a tuning fork to electrical vibrations of a certain pitch. He also lighted 200 lamps without wires from a distance of 25 miles and created man-made lightning producing flashes measuring 135 feet. He was very futuristic in his prophecies and like Darwin of the same period he was ridiculed for them. In 1900 he wrote:-

"In the near future we shall see a great many new uses of electricity....we shall be able to disperse fogs by electric force and powerful and penetrative rays.... wireless plants will be installed for the purpose of illuminating the oceans....picture transmission by ordinary telegraphic methods will soon be achieved.... another valuable novelty will be a typewriter electrically operated by the human voice....we will have smoke annihilators, dust absorbers, sterilizers of water, air, food and clothing....it will become next to impossible to contract disease germs and country folk will go to town to rest and get well....

"If we use fuel to get our power, we are living on our capital and exhausting it rapidly. This method is barbarous and wantonly wasteful and will have to be stopped in the interest of coming generations. The inevitable conclusion is that water power is by far our most valuable resource. On this humanity must build its hopes for the future. With its full development and a perfect system of wireless transmission of the energy to any distance man will be able to solve all the problems of material existence. Distance, which is the chief impediment to human progress, will be completely annihilated in thought, word, and action. Humanity will be united, wars will be made impossible, and peace will reign supreme."

Tesla believed that the inexhaustible electrical energy of the earth's atmosphere could be directly channeled to the consumer without wires or complex transmission systems.

In layman's language, his approach was recently described by Andrija Puharich, M.D.,LLD, in a paper entitled -"The Physics of the Tesla Magnifying Transmitter, and the Transmission of Electrical Power Without Wires."

"The Tesla system can be described in simple layman's language. Between the surface of the earth, and the upper atmosphere there exists an electrical potential of some two billion volts. This vast reservoir of non-depletable electrical energy shows us the magnitude of its available power fleetingly through the 100 lightning bolts that strike the earth each second. Tesla devised a system to tap this vast reservoir of energy. He showed that it is possible to oscillate this essentially static reservoir of electricity in a manner that would release it for practical power uses. This is done by using electrical energy from an existing hydroelectric power source to oscillate the earth-atmosphere electrical reservoir at a specific frequency which we will call the tesla frequency. The earth's electrical atmosphere oscillating at the tesla frequency can be tapped at any point in the earth with a tuned power receiver. Tesla demonstrated this effect by carrying a tuned light bulb in his hand which could be switched on to illumination without any wire connections. The same technology can power automobiles, ships, airplanes, homes, factories and communication systems."

"The Tesla system is clean because it draws on the natural supply of atmospheric electricity which is triggered by hydroelectric power. Tesla also worked out an economically feasible system of hydrolysis at hydroelectric power stations to yield hydrogen and oxygen. The hydrogen can then be used as a fuel in combination with atmospheric oxygen or in a fuel cell. Both methods yield clean energy. Tesla patented several solar energy collector devices which yield electrical power. These sources of energy plus the wireless transmission of electrical power constitute the four pillars of the Tesla world power system. These sources are not only clean, but renewable and non-depletable."

Tesla had a great penchant for privacy. He lived very much by himself. For many years, he lived at the Waldorf Astoria in New York and dined alone in full evening dress at a table especially set aside for him.

In his experimental facilities in the Rocky Mountains, he discovered many new principles of energy and transmission, most of which went to the grave with him because he had few collaborators and kept his secrets very much to himself.

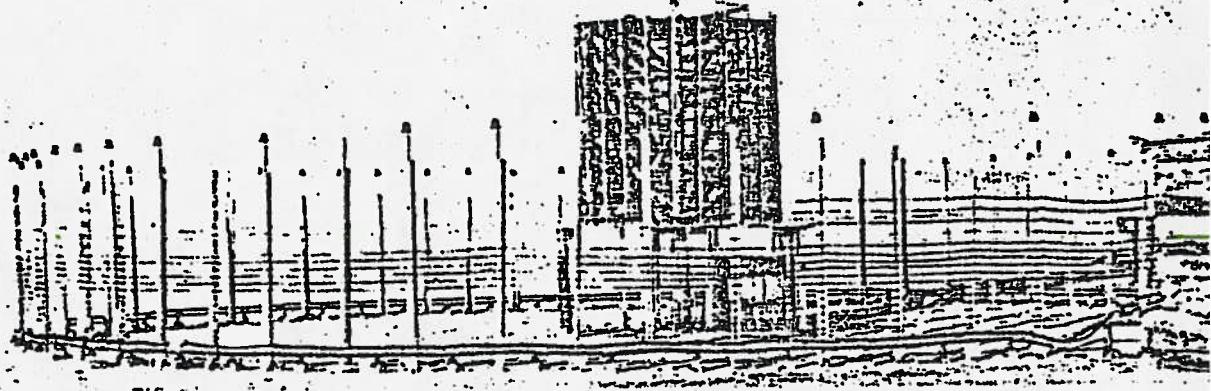
His brain tended to function in three dimensional form and he saw things very clearly as a vision. He had supersensory powers. These he reveals in his memoirs:-

"In 1899, when I was past forty and carrying on my experiments in Colorado, I could hear very distinctly thunderclaps at a distance of 550 miles. The limit of audition for my young assistants was scarcely more than 150 miles. My ear was thus over three times more sensitive, yet at that time I was, so to speak, stone deaf in comparison with the acuteness of my hearing while under the nervous strain."

It was Tesla who invented a supersensitive receiver to track electrical storms and produced the first man-made device to detect radio signals coming from the Cosmos. And this was 30 years before a similar achievement at the Bell Laboratories.

Tesla died impoverished. In 1912 he was chosen to share the Nobel Prize in physics with Edison but he refused it. Tesla contended that there was a definite distinction between the inventor of useful appliances and the discoverer of new principles. He regarded himself as a discoverer and Edison as an inventor.

When he died, his estate comprised some 100,000 documents written in four foreign languages and they included 13,718 pages of biographical material, 75,000 pages of letters to 6,900 correspondents, 34,552 pages of scientific articles, notes, drafts, articles and patents; all of Tesla's diplomas, scientific honours, and newspaper clippings. There were 5,297 pages of technical drawings and plans and over 1,000 photographs.



This photograph shows one of the very early Tesla coils. The more sophisticated versions developed later at this Colorado Springs site were housed in large buildings with a 4 foot diameter copper sphere elevated some 150 feet above the ground. A wireless transmitting tower built on Long Island, New York, was a sturdy structure 350 feet high.

These are now all housed at the Nikola Tesla Museum on Proletarian Brigade Street in Belgrade, Yugoslavia. In one of his papers he wrote:-

"Impossible as it seemed, this planet despite its vast extent, behaves like a conductor of limited dimensions. The tremendous significance of this fact in the transmission of energy in my system had already become quite clear to me. Not only was it possible to send telegraphic messages to any distance without wires, as I recognized long ago, but also to impress on the entire globe the faint modulation of the human voice. Far more significant is the ability to transmit power in unlimited amounts to almost any terrestrial distance without loss."

It was to prove this point that Tesla lit a bank of two hundred carbon filament lamps consuming about 10 kilowatts, 26 miles from the experimental station without any physical connection between them - something that has never since been repeated.

WHAT THE SOVIET UNION IS DOING IN HIGH
POWERED, PULSED, LOW FREQUENCY,
ELECTROMAGNETIC STANDING WAVES

On October 14th, 1976 radio communications all over the world were disrupted by powerful radio waves emanating out of Soviet Russia. Numerous official radio monitoring stations scattered throughout the world registered specific details on this occasion. Subsequently these signals reappeared, sometimes a very low frequency, sometimes a very high frequency and at irregular intervals for irregular lengths of time.

Official protests were lodged by Canada, Britain, United States and the Scandinavians to Russia who apologized for the interference, due they said to experiments they were conducting. Both amateur and professional radio communications personnel monitored these broadcasts, attempting to identify their nature, origin and purpose. The defense and intelligence services of the United States were particularly concerned and by December of 1976 they had convinced themselves that the bursts came from powerful Soviet "over-the-horizon radar signals". This became the official explanation for a while and it was very plausible.

But then the nature of the radiations changed dramatically. Very large standing electromagnetic waves were formed thousands of miles long, originating from below the ground and extending right up to the ionosphere. These standing waves had a periodicity varying between 4 pulses per second up to 26 pulses per second. Obviously, these could not be over-the-horizon radar signals; everyone had to rethink their ideas. For about a year these electromagnetic waves appeared sporadically with no further explanation from the Russians, only a promise to turn down their experiments and eventually stop altogether.

Innumerable explanations were put forth on the Western side, but the only substantial advance made was to determine that the electromagnetic radiation originated from a single source near Riga in Latvia. The transmitter at Gomel near Minsk was only brought into operation when things began to get out of hand in the spring of this year.

The present understanding of these phenomena (which is accepted by a large body of scientists and other professional analytical investigators but not by all of them and certainly not by the vast majority of politicians and other influential laymen) ties together a number of apparently disparate and independent events.

A Soviet scientist in Canada on an official exchange visit, said that he knew some now very old individuals in Russia who had in their youth known Tesla. Apparently sometime ago these individuals were approached by Russian scientists, who attempted to extract from them all the information they could recall regarding Tesla's early experiments.

While working in Quebec, this Soviet scientist and a lot of other unidentified people, including Canadian civil servants, visited Arthur Mathews (the last known surviving Tesla assistant) on many occasions and all wanted details of Tesla's original equipment.

The Soviet delegate indicated that duplication and development of Tesla's original work was being undertaken inside the Soviet Union.

After the Russians had been producing their very high powered, pulsed, low frequency, electro-magnetic standing waves, meteorological reports coming in to the National Centre of Atmospheric Research in Boulder, Colorado showed that a blocking mechanism was in effect along the west coast of North America. Another was located on the east coast and a third was located in Europe running north and south along the Polish/Russian border, extending up into Finland and down into Romania. These blocking mechanisms sometimes occur naturally but they never last very long. The three mechanisms lasted an unusual length of time, too long to be considered due to natural causes, and at the time there was no explanation for them, - rational or otherwise.

Simultaneously with these meteorological blocking mechanisms, very large standing electro-magnetic waves were detected which geographically coincided with them. These waves contained an enormous

amount of electrical excitation, enough according to some experts, to deflect the normal trade winds. While they lasted there was abnormal cold weather in the United States and Canada, with snow in Miami and floods and weather chaos in western Europe. After they were gone there was a very bad drought in the western part of the United States.

The military forces of the United States, directed from the Pentagon, use spy satellites to monitor Russian military activities. Amongst many other things they monitor the disposition of Soviet submarines around the globe. This is accomplished by detecting the very low frequency radiation produced by propellers of the submarines as they revolve. For some time the signals received by the spy satellites for this purpose had been interrupted by some strange signals which the Defense Chiefs were unable to identify until they were told of the existence of these very low frequency standing waves being produced by the Russians. They immediately checked and found that the signals they were receiving were indeed from this source.

In 1976 there was considerable publicity given to reports that the Russians had managed to aim a laser at some United States spy satellites and blinded them. Initially these reports were denied by the Department of Defense. Later the Pentagon admitted that the satellites had been blinded, but blamed it on the existence of unusual flares from disrupted gas pipelines within the Soviet Union. This was considered a far-fetched excuse. In more recent statements the Defense Secretary, Harold Brown, has admitted that two satellites had been destroyed by the Soviets using electron beam technology. Scandinavian intelligence sources claim that several more have been destroyed, but this cannot be confirmed.

For every physical object in the universe there is some frequency at which, if it is mechanically vibrated, it will resonate and the energy imparted at each cycle will accumulate and the amplitude of vibration will increase until the object breaks or shatters. It so happens that the resonant frequency for very large crude carrier vessels (the giant oil tankers) lies within the range of frequencies used by the Soviets to create these giant standing waves. Experts on both sides of the iron curtain now strongly suspect that these standing waves could cause such large ships, if caught in an area where the waves are being propagated, to break apart. More precisely, -investigations now underway are trying to determine whether some recent mishaps were so caused.

Neither have the works of Nikola Tesla been ignored in the United States. The Pentagon has been interested in some of the phenomena that Tesla described and have subscribed to experiments and development work based thereon. One of these is a contract with Golka Associates, Brockton, Massachusetts. This company was founded by Robert A. Golka, a man who has been intensely interested in and studied extensively, the works and theories of Nikola Tesla. Under this contract, in an Air Force hangar at Wendover, Utah, Robert Golka has constructed his modern equivalent of Tesla's experimental apparatus. His approach has not been to duplicate exactly Tesla's equipment and experiments, but to interpret them in terms of modern knowledge and modern materials, believing that in this way a quantum jump can be made to a point one stage further than Tesla actually achieved. His results have been outstanding, but, say the skeptics, unlikely to uncover the fundamental basic laws which only Tesla knew and took with him to the grave.

THE IMPACT THAT ELECTROMAGNETIC WAVES
APPEAR TO BE HAVING ON METEOROLOGICAL CONDITIONS

On November the 21st, 1977 a vast electromagnetic standing wave was observed off the Pacific coast of the Americas stretching from Alaska to Chile. Satellite photographs taken at the same time show cloud banks over this stretch of the ocean lying offshore over the whole of this distance, only grazing the land mass at California. Here the photographs showed what appeared to be a black line as though drawn by a ruler in the center of the cloud mass.

Close observation and measurement showed it to be an opening in the clouds one mile wide and 200 miles long. This is a phenomena that has no parallel in past records. There was no known explanation.

Although no scientific or lay predictions exist for such phenomena, retrospective correlation of the observation with theory indicates that the occurrence of such a gap in the cloud bank is consistent with the theory of gyrating tachyons that has been advanced to explain some of the results obtained by Tesla. (Tesla specified a minimum of 100 million volts for the Tesla Magnifying Transmitter. Such a

potential imparts a relativistic velocity to the individual electrons and through complex interactions of the several force fields creates electron-positron particle pairs, - the elusive tachyons.) When electrons are stripped from an atom the energy that previously bound them to the nucleus is released as excess energy, usually in the form of photons.

The standing waves with which the cloudbank off the Pacific coast was associated, persisted throughout December and into the new year. It appeared to be preventing the normal circulation of weather from west to east, at least across North America.

On the Pacific side of the blockage the weather has been unusually dry while the land side has experienced a record precipitation. With the normal circulation of the atmosphere blocked, the circumpolar vortex has wandered further south than is normal at this time of the year and appears to be controlling north American weather.

Throughout November, December and currently through January this air mass continues to descend over the whole of the mid and eastern continent, providing more precipitation and colder weather than is normal at this time of year. Whether there is a definite cause and effect relationship between these two simultaneous events has not been proven. Weather conditions although severe are not records.

On November 21st, the North American jet stream (the high speed, horizontally columnar, laminar flow, stratospheric air currents) shifted in a most unpredictable and unusual fashion. This resulted in air from over the Atlantic Ocean invading the eastern half of Canada and the United States.

There have been a series of mysterious high altitude explosions along the United States Atlantic Seaboard. Two occurred on December 2nd, five on December 15th, two on December 20th and one on December 22nd. In a few cases they were accompanied by flashes of bright light, but there appears to be some uncertainty in the observations as to whether the light flashes coincided with the sounds heard.

The Office of Science and Technology in the United States government, concerned as to the cause and nature of these explosions, in collaboration with the Pentagon, polled all the relevant government agencies as to whether they were responsible for them. None could give any explanation and all denied responsibility. Dr. William Donn a Columbia University Acoustics Scientist said the blasts are unlike anything ever heard before.

On December 27th, President Carter called for a full report. There is no evidence to link these explosions with the Soviet experiments in electromagnetic radiations, but there has been some speculation that they may be an unpredicted and entirely accidental by-product of Soviet attempts to set up a standing wave off the Atlantic coast similar to that on the Pacific side. Apparently such explosions would not be inconsistent with the tachyon theory and, in particular, since the excess energy released in the formation of electron-positron pairs appears in the form of photons, the light flashes observed can be accounted for.

This explanation at the moment is extremely tenuous since there is no confirming evidence and the formation of electron-positron pairs is postulated to occur at the source of energy in the presence of the 100 million volt electrical potential. It is a situation in which one has to keep an open mind, particularly as mysterious explosions of the type referred to here are not new. There are bona fide records of them having occurred at infrequent intervals elsewhere in the United States over the past 200 years.

The following is an excerpt from a report in the New York Times dated December 23rd, 1977:-

Three weeks of mysterious blasts along the Eastern Seaboard have led scientists to explore a number of explanations, but all they seem to agree on is that the blasts are strong and atmospheric, originating tens of miles offshore.

The latest booms were heard yesterday morning off the Carolinas and Wednesday night off the New Jersey coast.

The Pentagon, in fact, denied any knowledge of the blasts, apart from press reports, and said it had no explanation for them.

Dr. Donn's microbarographs record microscopic variations in barometric pressure, such as those generated by distant nuclear explosions. The pattern or "signature" of the offshore blasts bears no resemblance to such explosions, he said yesterday in a telephone interview.

It is clear that the occurrences were high in the atmosphere. They were not close enough to the ocean surface to generate seismic waves through the sea and through the earth's crust.

Seismic stations in North Carolina and New England recorded the effect, but only at travel times characteristic of the atmosphere. That is, they responded to an effect of atmosphere pressure waves on the earth in the immediate vicinity of each station.

Of the 25 such stations operated by the Western Observatory of Boston College, six, in southern New England, have sensed the blasts. In each case, according to Dr. Edward Chiburis of that observatory, the first record was made by a station near Danbury, Conn., being the one closest to a source area off South Jersey coast.

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Some events were observed as early as last July. They are definitely not a natural phenomenon, he said yesterday. He "just cannot imagine" any explanation other than sonic booms.

Sensitive equipment set up in California to measure the low-frequency, low-level variations in the earth's magnetic field, recorded some very local changes in that field which coincided with the establishment of the standing wave off the Pacific coast. This anomaly appears to be very localized and allowing for the limitations of the accuracy of measurement of the equipment used, it was estimated to be in the region of 40 miles in diameter. The measurements cannot be independently verified, which means that the results reported must be treated with some caution.

However, it is interesting to observe that there is a well known very localized gravity anomaly at this Palmdale, California location. Whether there is any connection between the two phenomenon has not been established but again the magnetic observations are not inconsistent with the Tesla theories. Measurements of the earth's magnetic field have revealed that it has a superimposed modulation at very low-frequency.

Long term observation of these fluctuations show that the beat is not steady but fluctuates erratically in both frequency and flux density. The overall pattern shows a remarkable similarity to patterns produced by electrical activity of the human brain.

ELECTROMAGNETIC FIELDS AND THE HUMAN BRAIN

Among the 150 different applications outlined by Nikola Tesla, were the worldwide transmission of speech; the worldwide transmission of telegraph; the transmission of electrical power over great distances; the generation of death-rays; the generation of a curtain of charged particles; the ability to modify weather patterns; the generation of isolated electrical plasmas (i.e. Fireballs) and man-made lightning.

Surprising as these may seem in their wide range, even more amazing is the claim by Tesla that any number of these phenomena could be achieved simultaneously and independently with one single equipment installation. If true, it represents something close to the ultimate in economic cost effectiveness.

In addition to all the foregoing, for more than 40 years reports have been written, experiments have been conducted and observations recorded, on the effects of electrical fields upon the mental faculties of human beings.

It is well known that strong pulsating electrical fields pulsing within the frequency range of the alpha and/or beta rhythms of the human brain can interfere with the physiological functioning of the mind and produce devastating psychological effects in most people.

Based on these observations there has been considerable serious investigation of the use of powerful radio transmissions as a mass psychological weapon in the arsenals of modern warfare. A Pentagon Defense Intelligence Agency classified report, parts of which have been released into the public domain, states that Soviet researchers have found that people exposed to low-level microwave radiation "experience more neurological, cardiovascular and hemodynamic disturbances than do their unexposed counterparts".

According to this report scientists from the Soviet Union know a lot about the biological effects of low-level microwave radiation, knowledge from which can be derived methods for causing disoriented human behaviour, nerve disorders or even heart attacks. The White House Office of Telecommunications Policy has been intensely pursuing similar studies but very few results have been reported to date. The Pentagon Defense Intelligence Agency report defines a malady known as "Microwave Hearing", in which sounds and possibly words appear to be originating intracranially, induced by signal modulation at very low average power densities.

Combinations of frequencies and other signal characteristics to produce other neurological effects may be feasible in several years, states the D.I.A. report.

The Soviets have also studied changes in body chemistry and brain function including heart seizure from microwave radiation. The latter has been accomplished experimentally in frogs by Soviet scientists who synchronized pulses of microwave signal with the animal's heart-beat, beaming the radiation at the frog's chest.

The relationship between these experiments and the Soviet practice of bombarding the United States, Moscow Embassy with low-level microwave radiation is obvious.

In a recent report, which we reviewed and was marked confidential, prepared by Andrijah Puharich, M.D.,LLD. the following thoughts were expressed (although the report was marked confidential the excerpts which we are including are basic scientific data and well known in sophisticated scientific circles):-

"...there is one application of the Tesla Magnifying Transmitter (TMT) that was not, to the best of our knowledge, described by Tesla. This is the possibility that the fundamental Tesla frequency (6.67 - 7.83 Hz) can act on the human brain in such a way as to influence behaviour through mind control. In order to test out this possibility Puharich and Beck undertook to carry out experiments on sophisticated humans with the following results:

(a) The magnetic pulse of the earth was monitored by means of a tuned magnetic coil, and it was found that the earth "beats" with a steady sine wave with a power peak at the upper end of the Tesla frequency, ca, 8 Hz.

(b) The earth, or artificially generated 8 Hz magnetic sine wave is not attenuated, nor wave-shape distorted by passage through the walls of a steel-copper "shielded" room.

(c) A weak (1mw) 8 Hz magnetic sine wave directed at a human being will entrain the brain waves in 4 to 6 seconds. The psychological effects of such 8 Hz magnetic wave entrainment are positive and beneficial.

(d) A weak (1 mw) 4 Hz magnetic sine wave will modify human brains waves in 6 to 10 seconds. The psychological effects of a 4 Hz sine magnetic wave are negative - causing dizziness, nausea, headache, and can lead to vomiting. This is a cholinergic effect.

(e) A magnetic wave above 8 Hz is also psychoactive, and produces somewhat negative (adrenergic) effects.

(f) The means and method used above to initiate and measure the psychoactive effects are all state-of-art. No means has yet been discovered to shield against the effects of such signals.

It is believed that the above laboratory-scale effects can be produced on a global scale by means of the TMT - to the extent that large populations could be electronically incited to unstable behaviour at the lower end of the Tesla scale, or to stable behaviour bordering on hypnosis at the other end of the scale. There are scattered observations from Canada that the Soviets have already achieved such effects in three Canadian cities."

It is known that the Canadian Government is monitoring the Soviet signals. From those who have observed this data, it is assumed that the Soviets are in the process of duplicating the Tesla Magnifying Transmitter. In his U.S. patents and other articles, Tesla concluded that when the earth is powered by Tesla Magnifying Transmitter within the frequency range from 0.01 Hz to 40 Hz with a power peak at 6.67 to 7.83 Hz the following effects can be produced:

1. Large amounts of electrical power can be transmitted without wires.
2. Change those electrical, ionic, and weather motion effects in the atmosphere, stratosphere and ionosphere which control weather.
3. It serves as a means of detecting motion moving below the surface of the sea, on the land, in the air or on the sea.

The article which follows discussing the magnetic fields of the human brain is from the January, 1978 edition of Science. It shows that electrically-induced magnetic fields are part of normal human brain activity and since any electromagnetic or magnetic field is susceptible to interaction with another, co-existing electromagnetic or magnetic field it follows that the human brain can be affected by an externally applied electromagnetic or magnetic field.

Somatically Evoked Magnetic Fields of the Human Brain

Abstract. *The human brain is found to produce a magnetic field near the scalp which varies in synchrony with periodic electrical stimulation applied to a finger. Use of a highly sensitive superconducting quantum interference device as a magnetic field detector reveals that the brain's field is sharply localized over the primary projection area of the sensory cortex contralateral to the digit being stimulated. The phase of the response at the stimulus frequency varies monotonically with the repetition rate and at intermediate frequencies yields a latency of approximately 70 milliseconds for cortical response.*

We report here the detection of magnetic fields associated with the flow of electric current in the brain in response to electrical stimulation of the fingers. Weak magnetic fields resulting from visual stimulation have previously been detected outside the scalp (1-4). In contrast to the diffuse nature of the visually evoked potential (VEP), which is con-

ventionally measured with scalp electrodes, the visually evoked field (VEF) is located over the visual cortex (2). This is to be expected as the electric currents giving rise to the VEF flow within the visual projection areas of the brain, while accompanying weaker currents in the skin remain undetected. The VEF has proved to be a significant indicator of brain function since its latency is directly correlated with the reaction time of a subject when the spatial frequency of a stimulus is varied (5, 6). The confined location of the VEF and its correlation with a measure of human performance prompted us to search for neuromagnetic responses evoked by other stimuli. The neuromagnetic response evoked by electrical stimulation of individual fingers of the hand—the somatically evoked field (SEF)—is similarly found to be well localized over the primary projection area, in this case on the contralateral hemisphere in the region SI for the stimulated digit. The observed features of the SEF indicate that the neuromagnetic techniques can provide unique advantages for medical research.

A split-ring electrode, fashioned from a rubber grommet and two stainless steel

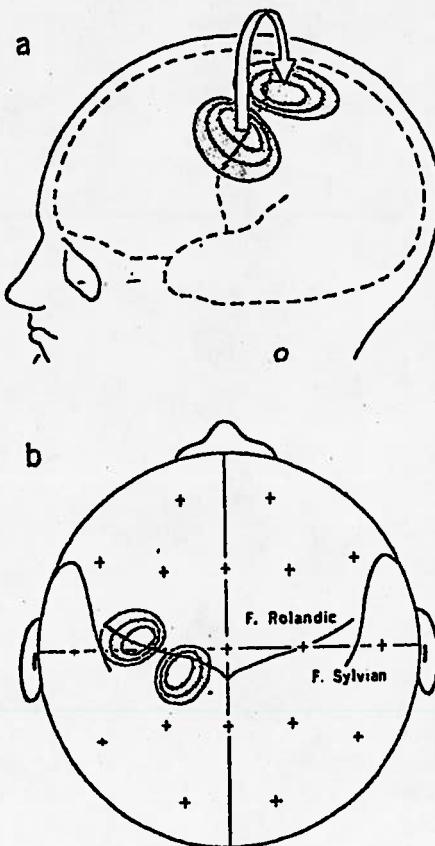


Fig. 1. (a) Neuromagnetic field patterns on the left hemisphere for an electrical stimulus at 13 hertz applied to the little finger of the right hand. Contours of equal magnetic flux indicate the relative amplitude of response for 0.9, 0.7, and 0.5 of the maximum response at the stimulus frequency. (b) The same pattern drawn on the conventional 10-20 electrode map. Abbreviation: F., fissure.

tabs, was used to apply 1-msec d-c pulses (1 ma) transcutaneously to either the little finger or the thumb at frequencies ranging from 3 to 30 pulses per second. Stimuli at all frequencies were distinctly experienced and described as moderate by all subjects. The evoked magnetic field was detected near the scalp by a superconducting quantum interference device (SQUID), using a flux transporter wound in the configuration of a second-derivative gradiometer, which is insensitive to uniform background fields and to background fields with uniform spatial gradients. An earlier version of this detector has been described elsewhere (7), and the principles of its operation have been explained (6). The lowest or "pickup" coil of the gradiometer was positioned 7 mm from and tangential to the scalp in order to detect the component of the field normal to the scalp. The coil diameter was 2.4 cm and the gradiometer baseline between adjacent coils was 3.2 cm. Both the SQUID and the gradiometer were immersed in liquid helium contained in a fiber glass Dewar positioned near the head. The SQUID electronics (8) provide an output voltage proportional to the magnetic flux linking the pickup coil. Like all of our previous experiments, these studies were carried out in a normal laboratory environment without magnetic shielding.

The detector output was amplified, band-pass filtered at the stimulus frequency, and averaged in real time over each 1-minute trial by a Waveform Educator (9). The averaged SEF component at the stimulus frequency exhibited an amplitude ranging from 0.1 to 0.5 picotesla (1 tesla = 10^4 gauss), depending on frequency. Despite environmental background fields of approximately 5 microteslas the noise rejection of our system provided a signal-to-noise ratio which ranged from 4 to 15 for the averaged signal. Experiments were performed with the subjects prone on an inclined plane, with their heads turned completely to one side or the other (10).

The field pattern for the most extensively studied subject is illustrated in Fig. 1. The magnetic field linking the pickup coil during the illustrated half of the response cycle emerges from one small region of the scalp and enters another close by. During the next half-cycle the field direction is reversed. The diameter of each of the two regions where the detected flux exceeds half of its maximum value is about 4 cm. This is an overestimate of the true size of the field pattern because of the limited resolution imposed by the relatively large di-

ameter of our pickup coil. The area between the centers of the two regions appears to lie directly over the primary sensory projection area for the contralateral little finger. This pattern is qualitatively similar to that which would be associated with a current dipole source (11, 12) located just under the scalp midway between the two regions and oriented parallel to the scalp but perpendicular to a line passing through the centers of the two regions.

The field pattern is reversed for the contralateral projection area when the little finger of the other hand is stimulated, indicating that patterns of current flow have bilateral symmetry. This result is not unexpected. When the thumb is stimulated instead, the entire pattern

shifts downward by approximately π . This correspondence with the location of the somatic projection areas for various digits (13) provides additional evidence for the cortical origin of the neuromagnetic response.

In addition to the field pattern studied, the phase of the average response at the stimulus frequency in the range 3 to 30 hertz. We arbitrarily fine phase as the occurrence of the maximum outward field in the upper region of the left hemisphere (Fig. 1) relative to the onset of the stimulus. For our moderate levels of stimulation, the phase response at a particular frequency was found to be independent of the subject amplitude for each of the subjects was also found to vary monotonically with frequency, as shown in Fig. 2. All four subjects exhibiting a common trend above 18 hertz. Below 18 hertz the data display considerably more subject variability. A trend within the context of an analysis of variance was performed for all data together. Data were censored for subjects to ensure that at least 10 observations per frequency for each subject were included. The *F* ratio for regression is significant at $P > 0.05$. The linear variation of phase with frequency can be characterized by a response latency of 61 ± 5 msec, as derived from the slope (14). Including only data above 18 hertz, where intersubject variability is considerably reduced, yields a latency of 70 ± 7 msec, with individual values ranging from 62 ± 8 to 79 ± 5 msec.

In separate psychophysical experiments the mean of the reaction times for the finger depressing a button in response to a single pulse to the little finger of the other hand was found to be 115 msec for the same four subjects. The difference of 102 msec between this neuromagnetic latency for stimulation above 18 hertz (or 111 msec for the pooled data) can be interpreted as the motor response time. We note that this value is comparable to the 115 msec value for the motor response time previously deduced from reaction times to neuromagnetic latency measurements with visual stimulation (5).

The origin of the larger phase differences between subjects when the stimulus frequency was less than 18 hertz is not understood at present. Subjects S.W. and J.L. yielded responses in a broad region around 15 hertz which seemed to be independent of the stimulus frequency. This phenomenon is evident in the data for E.M. Even though the nonlinearity of the phase trends

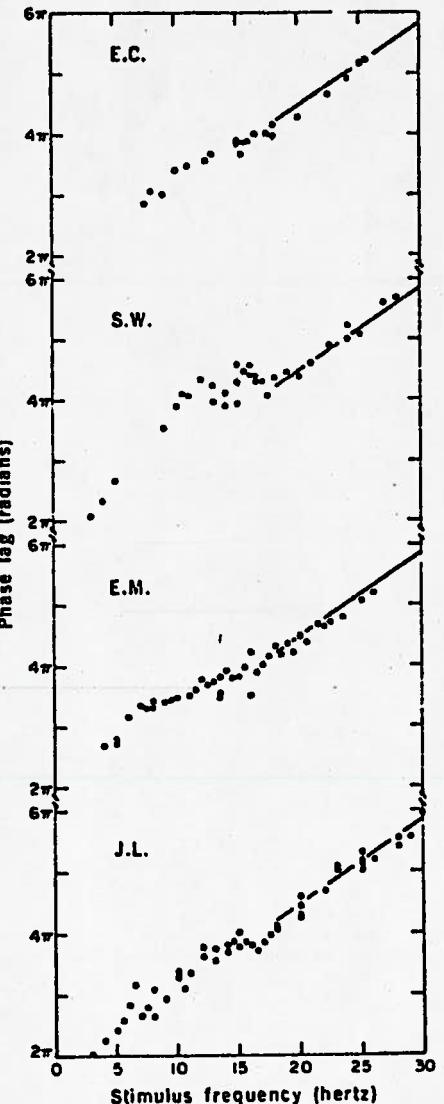


Fig. 2. Phase by which the average somatically evoked field from each of four subjects lags behind the stimulus for various stimulus frequencies. The solid line above 18 hertz is the best-fit line for data from all subjects. The phase values begin at 2π to ensure that the extrapolated values of phase lag for frequencies below 3 hertz are positive.

that several different fiber tracts may be differentially activated by stimuli as a function of frequency. This problem is suitable for further study.

The results reported here demonstrate that the SEF may provide information about brain activity that differs significantly from what can be observed with other methods. Most striking is the sharp localization of the field over the active region of the cortex, in contrast to the diffuse nature of potential recordings. Components of the transient SEP with a latency of 40 msec or greater are found over regions of both hemispheres (15), as opposed to the contralateral characteristic of the steady-state SEF. The generally good reproducibility of the phase of the SEF also makes neuromagnetic measurements attractive as a means of determining sensory response time, which should have clinical applications where estimates of nerve conduction velocity are desired. The opportunities for non-invasive mapping in the determination of sensory deficits as well as the study of sensory interactions all provide subjects for future investigation.

We conclude that for periodic somatic and visual stimulation, the neuromagnetic latency is a measure of neural transmission, with motor response times approximately constant regardless of stimulus modality.

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References and Notes

1. D. Cohen, *IEEE Trans. Magn.* MAG-11, 694 (1975).
2. D. Brenner, S. J. Williamson, L. Kaufman, *Science* 190, 480 (1975).
3. T. J. Teyler, B. N. Cuffin, D. Cohen, *Life Sci.* 15, 683 (1975).
4. M. Reite, J. E. Zimmerman, J. Edrich, J. Zimmerman, *Electroencephalogr. Clin. Neurophysiol.* 40, 59 (1976).
5. S. J. Williamson, D. Brenner, L. Kaufman, *Vision Res.*, in press.
6. S. J. Williamson, L. Kaufman, D. Brenner, "Biomagnetism," in *Superconductor Applications: SQUIDS and Machines*, B. B. Schwartz and S. Foner, Eds. (Plenum, New York, 1977), pp. 355-402.
7. D. Brenner, S. J. Williamson, L. Kaufman, in *Proceedings of the 145th International Conference on Low Temperature Physics—LT14*, M. Krusius and M. Vuorio, Eds. (North-Holland, Amsterdam, 1975), vol. 4, p. 266; D. Brenner, L. Kaufman, S. J. Williamson, *IEEE Trans. Magn.* MAG-13, 365 (1977).
8. S.I.I.E. Corporation, San Diego, Calif.
9. Princeton Applied Research Corporation, Princeton, N.J.
10. Four male subjects were investigated: E. C., age 43; J. L., age 24; E. M., age 23; and S. W., age 37. A minimum of 20 trials per subject were made at various stimulus frequencies.
11. G. M. Baule, Ph. D. thesis, Syracuse University (1964).
12. D. Cohen and H. Hosaka, *J. Electrocardiol.* 9, 409 (1976).
13. W. Penfield and T. Rasmussen, *The Cerebral Cortex of Man* (Macmillan, New York, 1950), p. 21.
14. D. Regan, *Evoked Potentials in Psychology, Sensory Physiology and Clinical Medicine* (Chapman & Hall, London, 1972), p. 77.
15. G. D. Goff, Y. Matsumiya, T. Allison, W. R. Goff, *Electroencephalogr. Clin. Neurophysiol.* 42, 57 (1977).
16. Supported by the New York State Research Council (contract C106219), the Naval Research (contract 00014-76-C-05), the National Science Foundation (grant 13162). We thank E. E. Coons for info and stimulating discussions and E. M. technical assistance.

19 May 1977; revised 17 August 1977

THE MILITARY IMPLICATIONS

Tesla built a mammoth magnifying transmitter rated at 75 million watts peak power. In an article in the February 1935 issue of Liberty Magazine, Tesla hinted that this could be adapted to military purposes in the form of a defensive weapon. In the article, he said:-

"My invention requires a large plant, but once it is established it will be possible to destroy anything, men or machines, approaching within a radius of 200 miles. It will, so to speak, provide a wall of power offering an insuperable obstacle against any effective aggression."

At the Geneva Conference of the Committee on Disarmament last summer, the USSR presented a massive document which turned out to be a draft agreement to prohibit development and manufacture of new weapons of mass destruction. The essential essence of the proposed agreement can be grasped from the first and last pages we produce here. The itemized subparagraphs of the Annex are important because they describe the kinds of things that the Russians know are feasible and can be used if they are not banned. They would not normally be so specific, - indeed they would not themselves normally initiate such a document or raise the subjects in negotiations. That they have done so point to them having investigated each item in detail, during which they would, of course, have attempted to devise advantageous use of them for their own ends. This would include experimentation and development sufficient to convince the hierarchy of the Politburo as to what the practical consequences would be if they were manufactured, deployed and put into operational use.

CONFERENCE OF THE COMMITTEE ON DISARMAMENT

CCD/511/Rev.1

8 August 1977

ENGLISH

Original: RUSSIAN

UNION OF SOVIET SOCIALIST REPUBLICS

Draft Agreement on the prohibition of the development and manufacture of new types of weapons of mass destruction and new systems of such weapons

The States Parties to this Agreement,

Guided by the interests of strengthening international peace and security,

Desiring to contribute to the cause of saving mankind from the danger of the use of new means of warfare, limiting the arms race and bringing about disarmament;

Recognizing that modern science and technology have reached a level where a serious danger arises of the development of new, still more destructive types of weapons of mass destruction and of new systems of such weapons,

Conscious that the development and manufacture of such weapons are fraught with the most serious consequences for the peace and security of nations,

Bearing in mind that recent years have seen the conclusion of a number of important agreements concerning limitation of the arms race and disarmament, including those relating to the prohibition of weapons of mass destruction,

Expressing the profound interest of States and peoples in the adoption of measures to prevent the use of the achievements of modern science and technology for the development and manufacture of the above-mentioned weapons of mass destruction,

Desiring to promote the strengthening of confidence among nations and the further improvement of the international situation,

Seeking to contribute to the realization of the lofty purposes and principles of the Charter of the United Nations,

Having agreed as follows:

Article I

Each State Party to this Agreement undertakes not to develop or manufacture new types of weapons of mass destruction or new systems of such weapons.

ANNEX TO THE AGREEMENT

An approximate list of types and systems of weapons of mass destruction covered by the Agreement on the prohibition of the development and manufacture of new types of weapons of mass destruction and new systems of such weapons

The following types and systems of weapons shall be prohibited by the Agreement on the prohibition of the development and manufacture of new types of weapons of mass destruction and new systems of such weapons:

- (1) Radiological means of the non-explosive type acting with the aid of radioactive materials.
- (2) Technical means of inflicting radiation injury based on the use of charged or neutral particles to affect biological targets.
- (3) Infrasonic means using acoustic radiation to affect biological targets.
- (4) Means using electromagnetic radiation to affect biological targets.

This list of types and systems of weapons to be prohibited may be supplemented as necessary.

The official phrases used in the Annex are deliberately vague in order to cover future unseen developments in the same category. Here is what they mean at the present level of development.

1. This is primarily a dispersion of plutonium or equally poisonous radio-active dust. The population can be virtually wiped out without any physical damage to property or land. Animals and vegetation would be affected. If materials with highly toxic radiation but short half-lives are used the net result would be similar to an ideal poison gas. A nuclear device can be designed to achieve this automatically. For non-nuclear warfare, dispersion can be accomplished as an explosive payload in a missile; sprayed from a cruise missile or by contaminating water supplies. Plutonium although most effective for this purpose, can render the affected areas unsafe for millennia. This precludes occupation by the aggressor. For practical implementation therefore, intensely radio-active isotopes of much lighter elements would have to be manufactured on a reasonably large scale. This could quite easily be achieved by using a dedicated nuclear reactor for irradiation.
2. This covers two kinds of weapon. Foremost is the neutron bomb and similar devices. The other is one form of the infamous "death ray" (the other main form of death ray is the laser). Technology, could in time, produce mobile and even hand gun versions of the machines now used for atom smashing. They would fire elemental sub-atomic particles like bullets from a super machine-gun. The effect on human and animal targets would be to destroy the living tissue by ripping apart the individual molecules.
3. High volume, ultra low frequency sound (i.e. below the threshold of human hearing) drives human beings and animals mad. It literally "interferes" with the overall coordination of mind and body. For very high volumes close to the targeted people, the body is reduced to pulp. This type of weapon, used in a less violent manner can insiduously incapacitate large populations without much physical destruction of property or overall loss of life. As a weapon for mass destruction in heavily populated areas it can be very effective. There is little possible in the way of defence against it. It is particularly suitable for urban guerilla warfare.

4. This is the use of broadcast radio waves, i.e. electro-magnetic radiation, - to disorient mass populations. The effects are simultaneous over the whole area blanketed by the radio waves and its effects can be made almost instantaneous, - requiring only a matter of seconds to initiate mental instability in each individual. On the other hand, it can also be used to slowly deteriorate the quality of mental activity and body functions by constant exposure to relatively weak radiations over an extended period. The advantages are the completeness of the coverage, near impossibility of defence against it and the fact that it involves no logistics. No hardware in the form of missiles, planes, tanks, warships, - nor troops - are required to penetrate enemy territory. The disadvantage is the inability to strictly define the area covered to suit requirements. For example, the radiated field cannot be made to conform to territorial frontiers. It is primarily a strategic weapon but can be adapted for tactical use by utilising high intensity beams directed at specific targets.

Major General G.J. Keegan, former head of U.S.A. Intelligence Activities, has pointed out that if the Soviet Union were to use intense particle beams against United States missiles, the situation will not be completely hopeless. If, he says, the beams consist of charged particles, used over long distances, fluctuations of the earth's magnetic field will cause deflections of the beams sufficient to render them ineffective. To take positive measures to counteract them, and in order not to rely upon such vague natural occurrences, the earth's field can be "wiggled".

Behind this remark lies an obvious implication that the United States not only knows how to do this but probably has, or shortly could have, the means to do this. If the Soviets use a beam of neutral particles, such as hydrogen nuclei, the beam could be dispersed by causing a large scale explosion in the atmosphere, elevating tons of heated air into and beyond the stratosphere.

Checking into the background surrounding the development of particle beam weapons we find that they were first proposed by scientists in the United Kingdom during World War II. During 1944 and 1945 the United Kingdom had an active program underway to develop a particle beam weapon. The project was abandoned, not because they were not making progress, but simply because they could not obtain enough electrical energy to continue their experiments. The United States government was not informed at the time and their scientists were unaware of any developments in this field. Much later the United States Defence Department initiated project SEESAW. This was abandoned some four and half years ago as impractical. Project SEESAW was based upon the use of an electron beam, which is known to be unsuited to this application. Both the United States and the Soviets in their latest experiments are using protons, and neutrons which are suitable.

One of the main planks in the Soviet science platform is their theory that this planet earth has a crystalline structure. It has been noted that when the Soviets set up a second transmitter to supplement the transmitter at Riga, they chose Gomel, - which according to their theory is one of the nodes of the earth's crystal lattice. The actual significance of this, or whether it is significant at all, is not clear, but a lot of people see it as important.

Reports of interference caused by Soviet over-the-horizon radar coming from a location near Kiev, erupted again in November and through December. The interference was so severe that it has prompted west European radio operators unions in ten different countries to consider seriously a boycott of service to Russian vessels. The extent of the interference can be gauged by the fact that airline-to-ground communications in Miami, Florida have been seriously affected.

The latest reports show that the Soviet transmitter sends out pulses occupying a bandwidth of approximately 100 kilocycles for a few seconds, then shifts to an adjacent frequency for a few seconds, in an apparently deliberately random sequence over a range of approximately one and a half megacycles. The coincidence of re-start of these transmissions with the occurrence of the standing wave off the west

coast of the Americas has predictably created speculation that there is a direct connection and that the two are parts of one and the same phenomena. Kiev is only 150 miles south of Gomel, but this distance is too large for any of the European nations to have mistaken radiations from Gomel as coming from Kiev. There are two possible scenarios.

- a) We know that the Soviets have developed and have begun to deploy a new radar system known as X-3. It is designed to be the key element in an anti-ballistic missile system for the defence of large cities. Its first application is in the defence of Moscow. It is extremely powerful, operating in frequency bands that the United States and Nato allies do not use for electronic warfare and employs a system of "frequency jitter", pulse shape and pulse repetition that makes it almost impossible to jam and against which no currently deployed equipment in the western allied arsenal is effective. The equipment is highly mobile and thus is highly survivable should hostilities break-out. The reported interferences are compatible with this radar system. Because of the peculiar sound that such radar signals make when listened to over audio facilities, it is known in the United Kingdom as "The Russian Woodpecker".
- b) According to reports on Russian transmissions issued by Borge Nielsen, Chief Engineer of the Danish Postal and Telegraph Administration, there are three not two sites for the so-called Tesla transmitters. If Mr. Nielsen is correct, then it is possible that Kiev is the third station, in which case the radio interference might not be radar originated but arise as harmonics of the fundamental frequencies used to set up the standing waves. This, of course, is pure speculation, but it must be taken into consideration in any serious study of the radio transmission experiments being undertaken by the USSR. Official U.S. sources place the third transmitter at Semipalatinsk.

Item four of Annex to the Soviet draft agreement has to be considered very seriously. There is a great deal of accumulated information covering the effects of extremely low-frequency (ELF) electro-magnetic field waves. These low-frequency fields have the capacity to penetrate buildings and living tissue, which means that they are potential biological stimuli.

Steel and copper screened rooms are designed to completely shut off all magnetic, electrostatic and electromagnetic radiation, but afford no protection at all against ELF field waves. Such radiations are associated with geo-magnetic disturbances, weather perturbations, electrical appliance discharges and seismic movements. They have an abnormal ability to propagate long distances without appreciable attenuation.

There is much experimental data showing that these fields can influence behaviour, ambulatory behaviour, oxygen uptake, endocrine changes, cardiovascular functions, and blood clotting.

Tesla called his most advanced development equipment, the "Tesla Magnifying Transmitter". With it, he claimed, it was possible to magnify the power dispersed from the apparatus manyfold. This has about it the ring of "something for nothing" and of defying the laws governing the conservation of energy. It has generally been interpreted as meaning magnifying the 'effective' power, - a very different proposition.

However, there is a phenomenon of radio broadcasting that occurs in the high arctic and in Antarctica in which radio waves appear to be trapped between two layers of ionisation in the ionosphere and propagate over considerable distances, giving rise in the process to Doppler frequency changes that impart an audible tone to the received signal when demodulated. They are known as "Whistlers".

Dr. Robert Helliwell at the U.S. Antarctic research camp known as Siple Station has undertaken extensive experiments to elucidate the behaviour and mechanisms of "whistlers". His results show fairly conclusively that radio waves can be magnified up to 1,000 times in the ionosphere. Details of his findings have been classified. Why? The Pentagon has contracts with Golka Associates to carry out Tesla's experiments, but these are ostensibly for application to fusion research. However, fusion research lies entirely within the jurisdiction of ERDA; the D.O.D. is not involved. There is much support for the notion that the Pentagon is up to more than meets the eye.

During the second week of January 1978 an official delegation from the U.K. was in the U.S.A. to discuss the events covered herein and to exchange information and ideas with U.S. investigators.

The situation, however, is not as one-sided as this report may indicate. The Governments of the western powers are fully aware of the Soviet operations and the interpretation that can be put upon them. In the United States the Defense Department has been trying to develop a death ray for more than a decade (as was reported in our report on nuclear fusion, February 1975).

The main work occurs at the Defense Department's laser weapons development group at Kirkland Air Force Base in Albuquerque, in New Mexico, and is known by the code name Eighth Card, operated under the aegis of the Defense Advance Research Projects Agency. For a long time they struggled with lasers and more latterly with beams of charged particles, making very slow progress, following a "brute force" approach.

In the last 18 months considerable advances have been made and significant results achieved. Since the disclosure that the Soviet scientists are developing electron beam weapons for use in outer space for the purpose of destroying enemy satellites and incoming missiles, the Pentagon has admitted that they have ongoing programs for the development of electron beam weapons. A wide range of laser based weapons are under development for a wide variety of uses by all three departments of the military. They range from infantry guns to blind enemy personnel, through laser guided bombs and missiles to heavy duty naval weapons, anti-missile defense systems and satellite killer weapons for use in outer space. The technology of using charged particles, either beams or curtains, - is nowhere near as advanced. The general consensus of opinion at the present time is that the Soviets have a tremendous lead in the development of actual lasers and charged particle high energy technology. Their hardware devices have much higher performance and greater power densities than their United States equivalents.

In the course of developing the material for this report, the analyst responsible examined copies of the official reports of the Department of Transport which monitor Soviet activities discussed in this report.

The photographs of the oscilloscope traces and the recorded measurements of the radio signals were all consistent with reports from other sources. They are of extremely low frequency, high amplitude, very distinctive wave form. These reports have been made available to the United States Government and its experts on a reciprocal basis. Since the November 21st phenomena appeared, reports have not been available. They have clamped down on all information in this area. What this means we are not able to conjecture.

It is too early to arrive at what the economic and political implications of these developments are except in broad terms which are self-evident to anyone who works in either the economic or political field.

In our view, an important aspect at this time is to be aware of these developments so that as news events are reported, they can be given a logical correlation and judgment can be brought to bear as to what the consequences and implications are likely to be.

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POSTSCRIPT

Subsequent to the preparation of this report, the following additional items came to our attention which may be of interest to the reader.

In the early 1960's Robert Uffen, a geophysicist at Queen's University, showed fairly conclusively that long-term worldwide climatic changes coincided with changes in the earth's magnetic field. This was taken up in a number of Universities.

At Columbia University, the Lamont Doherty geological observatory found that when the intensity of the magnetic field decreased the average temperatures decreased and vice versa. Dr. J.W. King of the Appleton Laboratory in the United Kingdom published in the January 18th 1974 issue of NATURE a paper which shows the link between meteorology and geomagnetism and thereby founded the science of magnetometeorology.

Dr. King's starting point is a remarkable similarity between the pattern of the magnetic field of our planet over the northern hemisphere and the pattern of the contour lines of atmospheric pressure. Both patterns have a double "pole" like a dumbbell and the dumbbell shape is aligned in much the same way for both pressure and magnetic distributions.

In meteorological terms the centres of low pressure that dominate northern hemisphere circulation coincide with the centres of greatest magnetic intensity. A great deal of evidence has been forthcoming to show that there is a very close correlation between weather and the earth's magnetic field and that variations in the magnetic field, particularly those variations caused by the eleven year sun spot cycle, have a direct effect upon the weather on this planet.

Three items associated with the SALT negotiations are significant and interrelated.

- (1) It is almost certain that it was the overwhelming desire of the Soviet authorities in 1976 to have the developments we have been discussing completed before the impending SALT negotiations began. To achieve

this, they instituted a crash program of development and were prepared to risk interruptions of worldwide communications and detection of their experiments and thereby disclosure of their objectives to the western powers. The ends justified the means.

(2) As part of this crash program, the Soviet scientists set up much larger more powerful standing waves, boosting the power to 40 million kilowatts producing what they calculated to be the optimum resonant frequency transmitted of 7 pulses per minutes. The result was enormous standing waves of an amplitude far greater than they had calculated. So large in fact that they were thoroughly frightened and shut down the equipment. Under normal circumstances when power is removed from standing waves in a resonant circuit they normally dissipate in what is termed a "damped oscillation", with the wave amplitude decreasing exponentially with each completed cycle and in a relatively short time they are dissipated altogether. However, in this case this did not occur and the standing waves maintained almost their full amplitude. Thoroughly alarmed, the Soviets started radiating intense bursts of high frequency power in efforts to disseminate these waves and make them fade away.

(3) During the SALT re-negotiations the Soviets most uncharacteristically and very suddenly requested that the clauses that banned the use of artificial manipulation of weather patterns as a means of waging war be modified to include very specifically the use of electrical means of stimulating and modifying global and local weather patterns. In making this request the Soviets were stepping completely out of line with their normal known methods of negotiation. On May the 18th, 1977 with what appeared to be imprudent haste, the Soviet Government signed an agreement with the United States and 29 other countries promising never to attack each other by starting man-made storms, earthquakes or tidal waves. The date is significant because at that time the Soviets were

desperately trying to disperse their standing waves by converting their transmitters at Riga and Gomel to send out giant pulses of very high frequency energy. There was no apparent success and the waves continued on throughout May and into June.

These three items when reviewed in context are obviously interrelated.

In 1975 United States Air Force Major General George J. Keegan, who until his recent retirement headed U.S.A.F. Intelligence activities passed to William Colby, then head of the C.I.A. and to a number of its nuclear scientific advisors, detailed information showing that the U.S.S.R. was developing a charged-particle beam device designed to destroy United States intercontinental submarine launched ballistic missile nuclear warheads. The activity is being carried on at Semipalatinsk some three hundred miles north of the Siberia/China/Mongolia joint border point. This installation involved a huge amount of civil engineering construction works, including enormous welded steel hollow spheres of such gigantic proportions that it is believed they are used as containers in which to detonate nuclear devices which thereby provide sufficient energy to drive the charged particle beams under development. The energy from the explosion is conducted over pressurized gaslines into giant capacitors inside one end of a large thick-walled building. Along the 700-ft side are located the electron injector gun and the collective accelerator. The power is fed into them to produce a proton beam which is bent at an angle by magnetic mirrors and propelled near the speed of light along drift tubes running underground about a kilometer. The drift tubes are evacuated to stimulate operating the beam in space and are used only for beam propagation testing. There are five concentric rings constructed around the building about five kilometers apart. At each 5 degree of arc a vertical sensor is placed to measure beam impact for beam tracking.

Even if this arrangement is successful in producing an effective electrical beam of charged particles sufficient to destroy an incoming ballistic missile, the whole thing is too cumbersome and clumsy for operational use. The amount of power is enormous and does not justify the end result. The dangers in operating something energized by nuclear detonation is enormous. At Azgir

in Kazakhstan near the Caspian Sea, the Soviets have built a powerful fusion pulsed magnetohydrodynamic generator as a possible alternative as a power supply for a charged particle beam system. Experiments took place last year in an underground chamber in an area of natural salt dome formations in the desert and was monitored by the United States early warning satellite stationed over the Indian Ocean. However, even this device would be too clumsy for actual operational use.

If Tesla was right about his apparatus being able to produce an electronic beam or wall of charged particles then this would be a far more suitable device for operational use. On a relative scale the equipment is very simple, the power input is much smaller and the system operates on basic principles and not by brute force, which is what the Semipalatinsk and Azgir operations are attempting. Members of the Soviet scientific delegation to Canada did say that the experiments on Tesla's work was directed towards producing a death-ray and a wall of charged particles.

Success in this endeavour has frightening implications. A curtain of such particles around Moscow or any other big city would shield against any missile attack. It is in this regard that the choice of Riga and Golem as sites for Tesla transmitters is significant. Curtains of charged particles thrown up from these two locations could, between them, intercept any missiles dispatched by NATO forces against Moscow. One additional installation located somewhere on a line between Moscow and Murmansk could intercept any missile fired against Moscow from the contiguous states of the U.S.A. Once the technology is thoroughly mastered the Russians could quickly defend all its major cities and major military installations, since in relative terms compared to other major defense projects, such as its naval power, the industrial and financial resources required would be modest. The military and strategic implications of this possibility can be readily appreciated.

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APPENDIX

THE ZAPPING OF AMERICA: Microwaves, Their Deadly Risk and the Cover-Up. Paul Brodeur, Norton, \$12.95. In 1971, a team of University of Alabama researchers studying birth defect statistics among white children in two Alabama counties came across a curious fact: from July 1969 to November 1970, 17 children had been born with clubfoot; statistically, there should have been no more than four. Further investigation yielded the astonishing intelligence that all 17 cases had been delivered in the Army hospital at Fort Rucker. And that wasn't the end; their fathers were all helicopter pilots.

Dr. Peter B. Peacock, head of the research team and chairman of the University of Alabama's Department of Public Health and Epidemiology, suspected that the causative factor was microwave radiation. Fort Rucker supported a heavy concentration of radar. Helicopter pilots fly at low altitudes where the microwave emissions are heaviest.

But plans to conduct a thorough study were thwarted: The Army chose not to cooperate.

Microwave usage on a large scale began during World War II with radar, which found the distance to targets by bouncing microwaves off them and timing the interval between the outgoing and returning signals. Since then, a phenomenal growth has taken place in devices that generate microwaves, some in small, some in powerful doses. A smattering of the microwave rollcall would include almost 1,000 television stations, 15,000 diathermy machines, several million microwave ovens, powerful broadcasting satellites, police radar guns and your automatic garage door opener. Industrial uses of microwave run the gamut from pre-cooking bacon to drying tobacco.

For almost as long as we have been using microwaves, evidence has been accumulating that they pose biological dangers such as cataracts, cancer and genetic damage. In 1971, an advisory council to the President warned that power levels in American cities, industries, and homes may already be biologically significant and the population at risk "may well be the entire population."

But, strangely, there has been virtually no systematic investigation in the United States of the effect of microwave radiation on people who have been exposed to it. The Soviet Union has conducted such studies and its precautions are far more broad than ours; for example, microwave ovens sold in the United States are permitted by law to leak up to five milliwatts per square centimeter—500 times more than the Russian standard allows.

The breaking of the news in February 1976 that the American embassy in Moscow was being subjected to microwave radiation by the Soviets may have ignited the first widespread public concern about the microwave danger (Russian knowledge of that danger makes their conduct doubly bizarre). Among the facts that subsequently emerged were that the Soviets had irradiated the embassy as early as 1962 but the State Department had kept that information from embassy employees...that Ambassador Walter J. Stoessel was suffering from bleeding of the eyes and from a blood disease akin to leukemia (he has since been transferred from Moscow)...that two of his predecessors, Ambassadors Bohlen and Thompson, had died of cancer...that, according to Zbigniew Brzezinski, the cancer rate among Americans in the Moscow embassy was the highest in the world...that 16 American women who served in Moscow developed breast cancer...that among embassy personnel given blood tests, the average lymphocyte (a white blood corpuscle) count was 40 percent higher than in other foreign service personnel...that State Department tests for genetic damage conducted on employees returning from Moscow found chromosomal breaks in significant numbers (the Department did not tell the employees the object of the tests).

Whether the Russians zapped the Embassy to foil American eavesdropping equipment, as they said, or for other reasons is unclear. Equally unclear is whether the State Department kept the facts of irradiation from its employees and the public out of some dopey concern for its "detente" policy, fear of lawsuits by enraged employees, or because of the secrecy with which the government surrounds microwaves.

As the government's largest user of microwave, the Defense Department funds the research to determine their dangers. Which, says Brodeur, puts the fox in charge of guarding the chicken coop and makes test animals of us all.

THE ZAPPING OF AMERICA is an important book not only for the valuable controversy it will provoke about microwaves and their effects, but also because it challenges the objectivity of any research by government agencies with too great a vested interest in the results.

(Published in The Washington Monthly/October 1977.)